Remarks/Arguments:

Claims 1-15 are pending in the above-identified application. Claims 16-27 have been withdrawn from consideration.

Rejections Under 35 USC §103

Claims 1, 2, 5, 8-12 and 15 were rejected under 35 U.S.C. § 103(a) as being obvious in view of ChenWilliams93 and Shum et al. This ground for rejection is overcome by the amendments to claims 1 and 12. In particular, neither ChenWilliams93, Shum et al. nor their combination disclose or suggest:

selecting at least two images corresponding to at least two of the plurality of fixed imagers to be used in creating the high quality virtual image each of the at least two images corresponding to respective viewpoints different from the virtual viewpoint;

b) creating at least two depth maps corresponding to the at least two images;

c) determining at least two sets of warp parameters using the at least two depth maps corresponding to said at least two images, each set of warp parameters corresponding to warping one of the at least two images to the virtual viewpoint;

d) warping the at least two images to generate at least two warped images representing the virtual viewpoint using the at least two sets of warp parameters corresponding to said at least two images; and

e) merging the at least two warped images to create the high quality virtual image representing the virtual viewpoint

as required by amended claim 1. Claim 12 includes similar limitations.

ChenWilliams93 disclose a view interpolation method to portray a scene based on morphing techniques as described in the Abstract. The described techniques begin with two images of the scene and, as described in the first paragraph of page 280, use the known camera position and orientation and range data corresponding to the images to produce morph maps between the images. There are two morph maps produced, representing forward warping, and backward warping, from one image to the other (Section 2.1, paragraph 1). These morph maps include offset vectors that indicate the amount each pixel moves from one image to the other. Using these morph maps, the method then generate an interpolated image

by linearly interpolating pixels of one of the images (the source image) along the offset vectors and forward mapping the source image to an in-between view. The ChenWilliams93 reference discusses the problems of overlap and holes that occur in interpolated images formed in this manner. The reference proposes the use of Z-buffering to overcome the problem of overlap. It also discuss several methods for overcoming the problem of holes, including the use of multiple interpolated images from different source images.

In the Office Action, it is admitted that ChenWillaims93 does not disclose the feature of step d) wherein the two generated warped images are each warped to an image representing the virtual viewpoint. In the Office Action, it is asserted that the Shum et al. reference discloses this feature.

Shum et al., however, disclose mosaicing images by blending them to form a composite image. The result is a texture map that does not correspond to a virtual viewpoint as it is composed of images corresponding to different viewpoints of each of the images or to the viewpoint of one of the original images. The system disclosed by Schum et al. does not generate two images representing a virtual viewpoint that is different from either of the source images and then combines those generated images to produce an image representing the virtual viewpoint. Instead, Shum et al. combine two images representing different viewpoints into a single image that represents both viewpoints. (See, col. 7, lines 31-34). The focus of Shum et al. is not on combining two warped images, each representing a virtual viewpoint but on combining two images representing different viewpoints so that there are no visible seams between the images. (See Figs. 9A-9D and col. 11, lines 25-40). It is noted that the resulting image in Fig. 9D includes the viewpoints of both of the input images. This does not meet the limitation of claims 1, 3 and 12 which all require that the viewpoint of the virtual image be different from the respective viewpoints of the at least two source images.

Because neither ChenWilliams93, Shum et al., nor their combination disclose or suggest these limitations of claims 1 and 12, these claims are not subject to rejection under 35 U.S.C. § 103(a) in view of ChenWilliams93 and Shum et al. Claims 2, 5 and 8-11 depend from claim 1 and claim 15 depends from claim 12. Accordingly, these claims are not subject to rejection under 35 U.S.C. § 103(a) in view of ChenWilliams93 and Shum et al. for at least the same reasons as claims 1 and 12.

Claim 3 was rejected under 35 U.S.C. § 103(a) as being obvious in view of ChenWilliams93, Shum et al. and Faugeras95. This ground for rejection is overcome by the amendments to claim 3. Claim 3 is amended in the same way as claims 1 and 12, described above. In particular, neither ChenWilliams93, Shum et al. nor Faugeras95, either alone or in combination include the limitations of claim 3. ChenWilliams93 and Shum et al. are described above. Faugeras95 concerns a method to reconstruct a three dimensional model of a static environment viewed by several cameras. (Introduction, paragraph 1) Faugeras95 discloses a method that may use a feature tracker to establish correspondences between images from the different cameras. (See Introduction, paragraph 6)

Faugeras95, however, neither discloses nor suggests a method to overcome the previously described deficiencies of ChenWilliams93. regarding this feature. That is to say, Faugeras95 does not disclose or suggest a method by which two source images are warped into two virtual images representing a virtual viewpoint that is different from the viewpoint of either source image and then the two virtual images are combined to form a single image representing the virtual viewpoint.

Further, the present invention, as recited in amended claim 3, contains an additional feature which is neither disclosed, nor suggested by the ChenWilliams93, Shum et al. or Faugeras95 either singly or in combination, namely:

> ... a) selecting the virtual viewpoint based on tracking at least one feature as the at least one feature moves within the scene;...

The Examiner has cited this use of a feature tracker by Faugeras95 as corresponding to this feature of claim 3, as amended. Applicants submit that this feature, which is described in the specification in paragraph [0064], is distinguished from the feature trackers of Faugeras95. The feature trackers of Faugeras95 identify static features in a set of snapshot images of the scene to establish correspondences between images of different cameras, while the present invention, as recited in amended claim 3, selects the virtual viewpoint based on tracking a feature of the scene in a sequence of images as it moves through the scene. This feature of the present invention may be used, for example, to allow an observer to automatically, and unobtrusively, follow a person, vehicle, animal, etc. as they move through the scene, as described in paragraphs [0041] and [0042].

Because neither ChenWilliams93, Shum et al. nor Faugeras95 disclose or suggest these features of claim 3, claim 3 is not subject to rejection under 35 U.S.C. § 103(a) in view of ChenWilliams93, Shum et al. nor Faugeras95

Claim 4 was rejected under 35 U.S.C. § 103(a) as being obvious in view of ChenWilliams93, Shum et al. and Trucco98. This ground for rejection is overcome by the amendment to claim 1, described above. In particular, Trucco98 does not provide the material that is missing from ChenWilliams93 and Shum et al. ChenWilliams93 and Shum et al. are described above. Trucco98 was cited as disclosing a disparity map which represents a solution to the stereo correspondence problem. Trucco98, however, does not disclose or suggest the limitations in claim 1, as described above. Because claim 4 depends from claim 1 and because Trucco98 does not provide the material that is missing from ChenWilliams93 and Shum et al., claim 4 is not subject to rejection under 35 U.S.C. § 103(a) in view of ChenWilliams93, Shum et al. and Trucco98.

Claim 7 was rejected under 35 U.S.C. § 103(a) as being obvious in view of ChenWilliams93, Shum et al. and Rogina01. This ground for rejection is overcome by the amendment to claim 1 from which claim 7 depends. ChenWilliams93 and Shum et al. are described above. Rogina01 was cited as disclosing a method in which a plurality of discrete two-dimensional images are acquired, each corresponding to an image of the scene observed from a plurality of discrete viewpoints on a predetermined viewpoint locus. In Rogina01, an image at the virtual viewpoint is generated by interpolating between two images at adjacent viewpoints. Thus, Rogina01 does not disclose or suggest "warping the at least two images to generate at least two warped images representing the virtual viewpoint," where the virtual viewpoint is different from the viewpoints of either of the source images. In Rogina01, there is no warping of the source images to the virtual viewpoint. Instead, the virtual image is generated by interpolating images at the fixed viewpoints.

Because neither ChenWilliams93, Shum et al. or Rogina01, either alone or in combination, include these features of claim 1 and because claim 7 depends from claim 1, claim 7 is not subject to rejection under 35 U.S.C. § 103(a) in view of ChenWilliams93, Shum et al. or Rogina01.

Claims 6 and 14 were rejected under 35 U.S.C. § 103(a) as being obvious in view of ChenWilliams98, Shum et al. and LuoMaitre90. This ground for rejection is overcome by the

amendment to claims 1 and 12 from which claim 6 and 14 respectively depend. ChenWilliams93 and Shum et al. are described above. LuoMaitre90 was cited as disclosing a particular method for creating depth maps. LuoMaitre90, however, does not disclose or suggest the limitations in claims 1 and 12, as described above. Because claim 6 depends from claim 1 and claim 14 depends from claim 12 and because LuoMaitre90 does not provide the material that is missing from ChenWilliams93 and Shum et al., claims 6 and 14 are not subject to rejection under 35 U.S.C. § 103(a) in view of ChenWilliams93, Shum et al. and LuoMaitre90.

Claim 13 was rejected under 35 U.S.C. § 103(a) as being obvious in view of ChenWilliams93, Shum et al. and Saito99. This ground for rejection is overcome by the amendment to claim 12, described above. In particular, Saito99 does not provide the material that is missing from ChenWilliams93 and Shum et al. ChenWilliams93 and Shum et al. are described above. Saito99 was cited as disclosing a method that forms a three-dimensional volumetric model that is used to resolve occlusions and to derive a depth map for each of the input views. Saito99, however, does not disclose or suggest the limitations in claim 12, as described above. Because claim 12 depends from claim 12 and because Saito99 does not provide the material that is missing from ChenWilliams93 and Shum et al., claim 13 is not subject to rejection under 35 U.S.C. § 103(a) in view of ChenWilliams93, Shum et al. and Saito99.

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Conclusion

In view of the amendments and arguments set forth above, Applicant respectfully request that the Examiner reconsider and withdraw the rejection of claims 1-15.

Respectfully submitted,

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Dated: January 26, 2006

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January 26, 2006
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